Water Pricing and Participatory Irrigation Management under Integrated Watershed Development Project in Jammu and Kashmir, India: Experiences and Lessons Learnt

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Abstract

India's water crisis is caused by the mismanagement of water resources, the solution does not lie merely in supply-side augmentations. State governments in India encourage the formation of water user associations (WUAs) .Integrated Watershed Development Project (IWDP), Hills-II, Jammu and Kashmir, India decision on participatory irrigation management (PIM) is a step in this direction. .With this backdrop, an attempt has been made to review the relevant literature on water pricing and PIM, to analyze the process and impact of evolving PIM under IWDP, responses to water pricing, and suggesting policy recommendations to recover project costs and collect water charges .

I. Introduction

Water is scarce and needs to be treated as an economic good. Allocation of water as a pure economic good is more complicated than other goods and services. There are externalities associated with it. Linkages between water, poverty and food security brings equity dimension into water allocation. India has embarked upon Participatory Irrigation Management (PIM), under which the management of some of the systems is being turned over to the Water Users Associations (WUAs). Integrated Watershed Development Project (IWDP), Hills-II, Jammu and Kashmir decision on PIM is a step in this direction. WUAs are expected to serve as channels for feedback and feed-forward information to improve the performance and services provided by O&M irrigation personnel. The initiatives of IWDP, Hills-II should be seen as the first step towards operationalizing water pricing and attaining sustainable irrigation water resource management. With this backdrop, an attempt has been made to review the relevant literature on water pricing and PIM, to analyze the process and impact of evolving PIM under IWDP, Hills-II, users responses to water pricing and reasons for low cost recovery, and to suggest policy recommendations to recover project costs and collect water charges from users.

II. Data and Methodology

IWDP, Hills-II, Jammu and Kashmir covers two sub-watersheds in Shivaliks, viz. Ramnagar and Akhnoor and two sub-watersheds in Karewas, viz. Rajwar and Rambiyara. The present study has been confined to two sub-watersheds of Akhnoor (Jammu district) and Ramnagar (Udhampur district). While Ramnagar is in the inner Shivaliks, Akhnoor is on its outer part. Ramnagar sub-watershed is the catchment area of Ramnagarwali Khad (ephermal) in the middle catchment of river Tawi. It is subdivided into 39 micro-watersheds. Akhnoor sub-watershed has been subdivided into 37 micro-watersheds.

Primary data has been collected using well-structured and pre-tested questionnaires, participatory rural appraisal (PRA) techniques and group meetings. Whenever possible and required, secondary data sources have also been utilized. Three WUAs each have randomly been selected from Akhnoor and Ramnagar sub-watersheds. Therefore, a total of six WUAs have been selected with the consultation of project functionaries at sub-watershed level. The sample size has been restricted to 90 members of the WUAs, and 780 households selected under IWDP (Hills-II) in the selected sub-watersheds. A total of 46 and 44 WUAs' members have been selected respectively from Ramnagar and Akhnoor sub-watersheds. For the collection of primary data and information on impact of PIM, three micro-watersheds/villages each from the two sub-watersheds of Akhnoor and Ramnagar, where a maximum number of people are known to have benefited from each project intervention have been selected. In the non-beneficiary category, three sample villages each have been selected on random basis, each 20-25 km away from the sampled micro-watersheds/villages (i.e., project area). Therefore, a total of six WUAs (three each from selected sub-watersheds) and twelve villages (six each from 'project' and 'non-project' area) have been selected for collection of primary data and information. In Ramnagar sub-watershed, 185, 119 and 72 households have been selected from project area with WUAs, project area without WUAs, and non-project area, and in Akhnoor sub-watershed, 158, 72 and 174 households have been selected from project area with WUAs, project area without WUAs, and non-project area respectively. The stratified sampling technique has been used to select villages (where WUAs have been created, as well as 'project' and 'non-project' villages). During the stratification, care has been taken to include both "forested watersheds' villages and agricultural watersheds' villages" in order to makes a comparative study. For the collection of primary data related to PIM, a purposive sample of approximately 20% of household level respondents in 'project' and 'non-project' area has been selected. The team strategy has been used to collect data and information. The content analysis technique has been used to analyze the data and information qualitatively and quantitatively (using descriptive statistics).

III. Water Pricing and PIM: Evidence from Literature

The 'water pricing debate' is intense in the developing world (Facon 2002). Water pricing has been contentious issues in public irrigation projects. Water charges are below operation and maintenance costs (O&M) of irrigation projects (Ahmad 2002, Easter 1993, Svendsen et al. 1997). This creates serious problems for sustainable irrigation water management. Several developing countries have poor performance in collecting water fees (Easter 1993). Water pricing is often proposed as efficient and effective measure in demand management (Brooks 1998). It results in revenue sufficiency, economic efficiency, equity and fairness, income redistribution, and resource conservation and should include public acceptability, political acceptability, simplicity and transparency, net revenue stability and ease of implementation (Bolland and Whittington 2000). This will help recover the cost of providing water delivery service, provide an incentive for efficient use of scarce water resources, and act as a benefit tax on those receiving water services to provide potential resources for further investment to the benefit of others in society (Perry 2001). The current pricing mechanisms are volumetric pricing (water use measured and charged), non-volumetric pricing (use of flat rates, per acre rates, crop-wise rates), and market based pricing (based on demand and supply) (Johansson 2000). Volumetric pricing is a simple device for conserving water supplies (Griffin and Perry 1985). For example, volumetric water pricing reduces water wastage and generates revenue for sustainable irrigation management (Briscoe 1996, Rosegrant 1997, Kumar and Singh 2001). Water pricing is a desirable way to allocate water efficiently (Johansson 2000, Dinar and Subramanian 1997). However, externalities in water use due to water recycling may render pricing less effective in reducing water use than foreseen by planners (Seckler 1996). Rather enforceable and transparent allocation rules may be more effective to curtail water demand (Ray 2001, Molle 2001).

Markets can be formal or informal (Shah 1993; Saleth 1996). Formal water markets require tradable property rights (Saleth 1998). Water rights help improves productivity and resource conservation (Burns and Meinzen-Dick 2005). In the absence of well-defined water rights, economic measures may lead to higher water use rather than conservation of water (Ahmad 2000). It is unjust to expect the farmers to bear the full burden (Sampath 1983, 1992, Rhodes and Sampath 1988).

Water is underpriced in most of the countries, neither reflecting its scarcity value nor allocated efficiently (Tsur and Dinar 1997). Water pricing on cost basis is essential for financial resource generation and efficient usage of water. Users tend to pay more than the actual cost of water under a flat rate pricing mechanism (Reddy 1998). Therefore, the willingness to charge is the main obstacle. Under the PIM, pricing on a cost basis may not lead to sustainability of the water systems in terms of efficiency and financial viability. For example, in India recovery rates are very low and declining (CWC 2004) and average recovery is less than 5% in most of the states (Deshpande and Narayanmoorthy 2006).

Water pricing have been kept low and fail to improve the irrigation water systems, technically or institutionally. The prices do not even cover the O&M costs of irrigation water (Deshpande and Narayanamoorthy 2001). GoI (1972) has suggested that water rate should relate to the benefits accruing to the farmers rather than the costs incurred by the department. Farmers are willing to pay substantially higher prices for improved water supplies (Reddy 1998), higher resource generation, efficient usage of water and low wastage. Water saving technologies is important in irrigation water demand management and to tackle the scarcity conditions. Use of sprinkler and drip irrigation techniques are spreading to a diversity of crops, besides horticultural crops (Kumar et al. 2004) and used even on water-intensive crops like sugarcane (Narayanamoorthy 2006), where the economic viability seems to hold good.

WUAs have turned into mere political entities and majority of contractors have become WUA presidents. These have become money-making ventures (Reddy 2003). Sustainability of benefits is uncertain due to lack of efficient institutional structures. Equity in water management and distribution is not addressed (Reddy and Reddy 2005).

Regular elections are one way of keeping them alive (Reddy 2006). PIM has created a divide between the large and small farmers, and the landless and causing much misery (Das 2006). O&M of irrigation systems through WUA is expected to bring in efficient and equal distribution of water resources, but were found to be difficult to replicate. Water pricing should take the equity concerns into account using discriminatory pricing policies.

IV. PIM under IWDP (HILLS-II)

IWDP (Hills-II) has started the process of modernization and repair of the existing water harvesting structures and gravity based irrigation water distribution channels. User groups have been involved in repair, maintenance and improvement of the physical structures, as well as water management on cost-sharing basis mainly in the form of voluntary free labour. The project has played a vital role in clearly defining the relative rights and obligation for users communities, which are part of a larger integrated system as well as the rights of user communities with those outside.

a. Formation of WUA

WUA is the basic foundation of the irrigation reform process under the IWDP (Hills-II). The process of formation of a WUA was simple. Initially, WUAs have been formed in those areas where physical infrastructure for irrigation already existed but needed repairs and maintenance. The participatory development staff along with village panchayat had identified the user-farmers.

b. Operation of irrigation system

The entire reform process has been repair and renovation oriented. The majority of the works was done through WUAs along with panchayats. The Project authorities have given clear instructions that there will be no new structures, or alteration of original designs. So, the major emphasis is on restoring the designs. In some cases, the president of WUAs has difficulties owing to lack of proper manpower and material planning resulting into losses.

c. Allocation rules

The physical facilities are maintained in good working condition and regulate access to facilities provided by it. One of the crucial factors on which the authority and credibility of the WUA depends is its ability to ensure an equitable distribution of benefits takes place and any free rider is penalized. Irrigated water is used essentially for paddy cultivation. The extent of area to be cultivated as well as the timing of the start of irrigation in a particular season is generally decided by the users' association. As the entire service area cannot be irrigated, the system is confronted with the problem of rationing supplies.

d. Maintenance of irrigation system

The purpose of 'maintenance' is to ensure that physical facilities function smoothly and at the level of performance for which they were designed. If the maintenance is inefficient, the volume of water made available to the fields get reduced, which hampers the level of output. WUAs have established conventions regarding the timing of repairs, , responsibility of members and the obligations of users. Large landowners have dominated the WUA functioning, as they cultivate a large proportion of land. Thus, the land tenure system has influenced the management of local water control systems.

e. Benefits and costs

The potential beneficiaries were mobilized on issue related to fair sharing of the benefits and costs. It was emphasized that users participation will result in costeffectiveness in repairs and maintenance and efficient management once it is commissioned. There was provision of equitable distribution of water based on the size of land holdings .The executive committees of the WUA mediate disputes among its members before it moves to panchayats.

f. Transparency and accountability

Transparency is one of the key principles of PIM. The management committees of the WUAs were disseminating information on various activities for efficient management of the irrigation systems. With PIM, the project functionaries were playing the role of facilitators and made accountable and responsible to the farmers organizations.

V. Impact of PIM

There are perceptible economic gains to the farmers after the initiation of PIM. The formation and operationalization of the WUAs have resulted into increase in area under cultivation and ensure timely sowing of crops and receipt of water .The level of income from various crops has increased as compared to the income levels prior to the formation of WUAs.

a. Reduction in rainwater loss and sediment yield

The Micro-level watershed planning was carried out using the sweeping transect and emphasis has been given on soil erosion control on hill slopes and gullies, regulation of water flow system in watershed drainage, and rearrangement of farmlands. The Adverse climatic factors of the Shivaliks necessitated the adoption of micro catchment techniques for run-off harvesting and conservation practices as done in similar areas elsewhere. The usefulness and scope of rainwater harvesting and conservation practices in improving tree growth in arid zones have been amply demonstrated.

b. Status of water resources and irrigation

Table 1 presents data on surface and ground water resources across the sampled sub-watersheds. Both the average number of water points (bowlies) as well as gravity based water points per village was comparatively higher in project area with WUA than without WUA and non-project area.

A mere perusal of the Table 1 makes it clear that the number of water harvesting structures were more in project area with WUA than project area without WUA and non-project area. Similar is the case with the length of irrigation channel. The number of water harvesting structures as well as length of irrigation channel was significantly higher in project area than non-project area. The quality of water harvesting structures were also reportedly better in project area with WUA than non-project area, due to participatory repairs and renovation activities as well as maintenance initiated by the project.

C. Change in crop intensity and crop productivity

As a result of improved soil moisture regime, increased irrigation resources and high use of fertilizer (including cow-dung), the cropping intensity has improved in the project area compared to non-project area, which clearly reveals significant variations across the selected sub-watersheds evident from the figures(see Table 3). The difference in cropping intensity was reportedly negative across the project area with WUA and without WUA as well as non-project area. For instance ,project area with WUA and without WSA present 58.26% and 46.27% less cropping

intensity respectively with respect to non project areas. (see Table 4).
The overall soil-moisture regimes have also improved after project intervention.

VI. Users Responses to Increased Water Pricing

With increase in water pricing, 22% of the user demands less water and leaves land fallow, 18% applies less water to the crop accepting some yield loss, 36% switches to less water demanding crops and 43% invests in more efficient irrigation techniques.

Water pricing has been found less effective where water is relatively abundant and the price is relatively low.

VII. Reasons for Low Cost Recovery

Water fee collection rates are low due to no linkage between fees collected and funds allocated to an irrigation project, lack of farmer participation in project planning and management, poor communication and lack of transparency between farmers and irrigation management, and poor water delivery service. The responsibility for fee collection has been shifted to WUAs.

Water prices are too low and services are not related to water charges. There are no incentives for service providers to collect fees. O&M fees are area-crop–based. Water user participation has been encouraged by establishing WUAs.

VIII. Improving Cost Recovery and Reducing Water Use

Water pricing must covers the appropriate costs i.e. costs based on volumetric use . Appropriate costs must be determined through users' consultation and irrigation agencies. Appropriate fee is influenced by the type of irrigation system and ability to measure and monitor water use. When volume of water delivered cannot be measured, water charges are usually based on area irrigated. Sometimes area-based charges are adjusted for crops grown and season of the year. Even if the appropriate water charge is determined, achieving high collection rates is more difficult. Therefore, financial autonomy should be given for collecting funds. Besides, revenues from water charges must be used for improved O&M services. Shifting irrigation project management to a financially autonomous organization like a local WUA will create a financial incentive for improving irrigation services. Financial autonomy to WUA will improve irrigation water management and return revenue to the project.

IX. Lessons Learnt

The institutional reforms in irrigation water management initiated under IWDP (Hills-II) were both bold and innovative. WUAs have taken up the maintenance activity with the financial support provided by the project. Due to physical improvements in the irrigation system, water availability has improved addressing issues like institutional structure, accountability, transparency, and sustainability. Institutional changes are still in progress. In future, linkages need to be established which will make WUAs independent of project support. There is need to redefine the role of irrigation agency, which calls for suitable institutional restructuring. Ultimately, WUAs will need to be financially self-sustainable. In past, in other parts of the country where WUAs were formed, many became defunct due to financial bankruptcy.

A transparent consultation process allowing farmers to participate in decision-making improves their willingness to pay water charges is an important stepping stone toward increasing their authority. Government should provide farmers and WUAs with training and technical assistance for widening farmers' responsibilities and authority over water management.

The irrigation water supply agency (WSA) needs to be made financially autonomous for cost recovery and pricing using incentives and penalties to encourage farmers to pay their water charges Water charges have to be equitable, simple, and easily understood by users and collecting agency. There is need to involve all relevant stakeholders in identifying the full range of services and benefits produced and allocating costs among all beneficiaries. When water metering is not possible, area-crop and area-technology based water charges should be designed to strengthen farmers' incentive to shift to crops that need less water, or to shift to water-saving technologies, or both. Water markets should be encouraged as a means of improving water allocation and conservation.

Another weak link has been the issue of accountability. The roles and responsibilities of all the agencies concerned must be further defined. There is need to transfer all the operation and maintenance function to the WUAs in near future. The role of the project functionaries or line department needs to be curtailed. At the same time, there is needed to form federations of WUAs, for which continued support and training are required. There is urgent need to forge suitable linkages with reputed local NGOs, training institutes and line departments to equip the farmers' organization in various aspects of

PIM. No doubt, adequate groundwork and the required environment are created, there is need to give a closer look to the weaknesses and remedy them. More importantly, a regular monitoring mechanism has to be put in operation to initiate corrective measures as and when needed.

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Table 1: Status of water resources and irrigation (per village)

Item	Unit	Project area with WUA		Project area without WUA		Non-project area	
		Forested WS	Agrl. WS	Forested WS	Agrl. WS	Forested WS	Agrl. WS
Surface water supply							
Natural water points (Bowlies)	No.	6.8	4.3	5.2	3.4	3.6	2.6
Gravity based water points	"	5	2	2	1	1	0
Ground water supply							
Hand pumps	"	2	3	0	1	0	1
Water harvesting structures	"	3.5	2.9	2	1.8	1.2	0.7
Irrigation							
Irrigation channel	No.	2.8	1.7	1.8	1.2	1	0.8
Gross irrigated land	Ha.	98	67	48	64	69	44
Net irrigated land	Ha.	68	36	34	37	27	18
Irrigation intensity	%	144.11	186.11	141.17	172.97	255.56	244.44

Note: Irrigation intensity = Gross irrigated area / Net irrigated area x 100

Table 2: Difference in status of water resources and irrigation (per village)							
		Project area with WUA - Project area without WUA		Project area with WUA - Non-project area		Project area without WUA - Non-project area	
Item	Unit	Forested WS	Agrl. WS	Forested WS	Agrl. WS	Forested WS	Agrl. WS
Surface water supply							
Natural water points (Bowlies)	No.	1.6	0.9	3.2	1.7	1.6	0.8
Gravity based water points	"	3	1	4	2	1	1
Ground water supply							
Hand pumps	No.	2	2	2	2	0	0
Water harvesting structures	"	1.5	1.1	2.3	2.2	0.8	1.1
Irrigation							
Irrigation channel	No.	1	0.5	1.8	0.9	0.8	0.4
Gross irrigated land	Ha.	50	3	29	23	-21	-20
Net irrigated land	Ha.	34	-1	41	36	7	19
Irrigation intensity	%	2.94	13.14	-111.45	-58.33	-114.39	-71.47

Table 3: Crop intensity and crop yields							
		Project area with WUA		Project area without WUA		Non-project area	
Item	Unit	Forested WS	Agrl. WS	Forested WS	Agrl. WS	Forested WS	Agrl. WS
Gross cropped area	Ha.	163	74	73	107	113	68
Net sown area	Ha.	158	68	57	93	70	42
Crop intensity	%	103.16	115.63	128.07	146.58	161.42	161.9
Non-seed inputs and crop yields							
Maize	Qntl./Ha	96	9.9	8.2	8.5	7.5	7.6
Paddy	"	5.2	6.2	4.5	8.5	4.4	4.5
Pulses	"	2.64	2.8	2.3	2.4	2	0.3
Wheat	"	8.96	9.9	8.2	8.4	7.6	7.8
Seed inputs and crop yields							
Maize							
Local	Qntl./Ha	13.13	14.2	12.6	13.7	10.3	11.2
Hybrid	"	15.6	15.8	14.9	14.1	11.7	11.9
Difference	"	2.3	1.6	2.3	0.4	1.4	0.7
Paddy							
Local	"	10.8	11.2	9.4	10.3	9	9.2
Hybrid	"	12.3	13.1	11.4	11.7	10.1	10.7
Difference	"	1.5	1.9	2	1.4	1.1	1.5
Wheat							
Local	"	18.4	19.7	16.9	17.4	16.1	16.7
Hybrid	"	21.3	21.8	20.4	21.1	17.3	17.9
Difference	"	2.9	2.1	3.5	3.7	1.2	1.2
Note: Crop intensity = Gross cropped area / Net area sown x 100							

Table 4: Difference in crop intensity and crop yields

Item	Unit	Project area with WUA - Project area without WUA		Project area with WUA - Non-project area		Project area without WUA - Non-project area	
		Forested WS	Agrl. WS	Forested WS	Agrl. WS	Forested WS	Agrl. WS
Gross cropped area	Ha.	90	-33	50	6	-40	39
Net sown area	Ha.	101	-25	88	26	-20	51
Crop intensity	%	-24.91	-30.95	-58.26	-46.27	-33.35	-15.32
Non-seed inputs and crop yields							
Maize	Qntl./Ha	1.4	1.4	2.1	2.2	0.7	0.8
Paddy	"	0.7	1.6	0.8	1.7	0.1	0.1
Pulses	"	0.34	0.4	0.64	0.5	0.3	0.1
Wheat	"	0.76	1.5	1.36	2.1	0.6	0.6
Seed inputs and crop yields							
Maize							
Local	Qntl./Ha	0.7	0.5	3	3	2.3	2.5
Hybrid	"	0.7	1.7	3.9	3.9	3.2	2.2
Difference	"	0	1.2	0.9	0.9	0.9	-0.3
Paddy							
Local	"	1.4	0.9	1.8	2	0.4	1.1
Hybrid	"	0.9	1.4	2.2	2.4	1.3	1
Difference	"	0.5	0.5	0.4	0.4	0.9	-0.1
Wheat							
Local	"	1.5	2.3	2.3	3	0.8	0.7
Hybrid	"	0.9	0.7	4	3.9	3.1	3.2
Difference	"	-0.6	1.6	1.7	0.9	2.3	2.5